

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

|  |  |   |                       |
|--|--|---|-----------------------|
| Applicant's or agent's file reference<br>53047-48385   | <b>FOR FURTHER ACTION</b>  |   | See Form PCT/IPEA/416 |
| International application No.<br>PCT/US04/16398  | International filing date (day/month/year)<br>21 May 2004 (21.05.2004) | Priority date (day/month/year)<br>23 May 2003 (23.05.2003)                              |                       |
| International Patent Classification (IPC) or national classification and IPC<br>IPC: G06F 17/30 (2006.01); G06F 15/78 (2006.01)<br>USPC: 707/1-10, 100-104.1, 200-206  |  |   |                       |
| Applicant<br>WASHINGTON UNIVERSITY   |  |   |                       |
| <p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>8</u> sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input type="checkbox"/> (sent to the applicant and to the International Bureau) a total of <u>0</u> sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p> <p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input checked="" type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p> |  |   |                       |
| Date of submission of the demand<br>06 January 2005 (06.01.2005)   |  | Date of completion of this report<br>13 March 2006 (13.03.2006)                         |                       |
| Name and mailing address of the IPEA/US<br>Mail Stop PCT, Attn: IPEA/US<br>Commissioner for Patents<br>P.O. Box 1450<br>Alexandria, Virginia 22313-1450<br>Facsimile No. (571) 273-3201  |  | Authorized officer <u>Rita Vior</u><br>JEAN B. FLEURANTIN<br>Telephone No. 571-272-9000 |                       |

Form PCT/IPEA/409 (cover sheet) (April 2005)

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## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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## Box No. I Basis of the report

1. With regard to the language, this report is based on:

- ☒ the international application in the language in which it was filed.
- ☐ a translation of the international application into English, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
- ☐ publication of the international application (under Rule 12.4(a))
- ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

- ☒ the international application as originally filed/furnished
- ☒ the description:
- pages 1-49 as originally filed/furnished
- pages\* NONE received by this Authority on \_\_\_\_\_
- pages\* NONE received by this Authority on \_\_\_\_\_
- ☒ the claims:
- pages 50-63 as originally filed/furnished
- pages\* NONE as amended (together with any statement) under Article 19
- pages\* NONE received by this Authority on \_\_\_\_\_
- pages\* NONE received by this Authority on \_\_\_\_\_
- ☒ the drawings:
- pages 1-47 as originally filed/furnished
- pages\* NONE received by this Authority on \_\_\_\_\_
- pages\* NONE received by this Authority on \_\_\_\_\_
- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☒ The amendments have resulted in the cancellation of:

- ☒ the description, pages NONE
- ☒ the claims, Nos. NONE
- ☒ the drawings, sheets/figs NONE
- ☒ the sequence listing (*specify*): NONE
- ☒ any table(s) related to the sequence listing (*specify*): NONE

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to the sequence listing (*specify*): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

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Box No. IV Lack of unity of invention

1. ☒ In response to the invitation to restrict or pay additional fees the applicant has, within the applicable time limit:
- ☐ restricted the claims.
  - ☒ paid additional fees.
  - ☐ paid additional fees under protest, and, where applicable, the protest fee
  - ☐ paid additional fees under protest but the applicable protest fee was not paid
  - ☐ neither restricted the claims nor paid additional fees
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is:
- ☐ complied with.
  - ☒ not complied with for the following reasons:

Please See Continuation Sheet

4. Consequently, this report has been established in respect of the following parts of the international application:
- ☐ all parts
  - ☐ the parts relating to claims Nos. \_\_\_\_\_

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

IV. 3. This Authority considers that the requirement of unity of invention is accordance with Rules 13.1, 13.2 and 13.3 is not complied with for the following reasons:

Re Item V.

1. Claims 1 -15, 17 - 28, 65 - 72

1.1 CLAIMS 1, 2 & 17

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1, 2 & 17 is not new in the sense of Article 33(2) PCT.

Document D1 discloses a programmable logic device (see e.g. page 6, right hand column, lines 25 - 29: "... based on a simple cell that can be programmed to recognize a single character... These cells are then connected to form arrays ...") for searching for patterns on a (continuous) data flow from a disk subsystem (see page 5, left hand column, lines 31 - 33: "The term selector checks the input stream for occurrences of the terms specified in the user's query." and further on: "The term detector can operate at a high bandwidth matching that of the disk, ...")  
In view of these disclosures of document D1, claims 1, 2 & 17 do not fulfill the requirements of Article 33(2) PCT.

1.2 CLAIM 15

The technical features as described in claim 15 seem to be contradictory within the claim, therefore, in order to access novelty and/or inventive step of this claim, it has been interpreted by the examiner in its technically broadest meaning.

The claim states that the device interfaces the mass storage device with a system bus, at the same time the device is in communication with the mass storage device over a computer network. This seems to be a contradictory statement with regard to the technical features of the connection between the device and the mass storage medium, therefore this connection is technically regarded as any suitable sort of local connection between a programmable device and a mass storage medium.

Due to the above mentioned unclarity with regard to the exact technical features of the connection between the device and the mass storage medium, the disclosures of document D1 also render the subject-matter of claim 15 as not new (Lack of Novelty, Article 33(2) PCT).

1.3 CLAIMS 65 & 69

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## Supplemental Box

The present application does also not meet the criteria of Article 33(1) PCT, because the subject matter of claims 65 & 69 does not involve an inventive step in the sense of Article 33(3) PCT.

As already mentioned, Document D1, considered to represent the most relevant state of the art to the subject matter of claim 65, discloses a programmable logic device for searching for patterns on a continuous data flow from a disk subsystem.

The subject-matter of independent claim 65 differs from the disclosure of D1 in that the programmable logic device is not used to search for patterns in the continuous data stream, but to perform a compression operation on the received data and to store the compressed data in the data storage medium.

However, using programmable logic arrays, e.g. a FPGA, for compressing data is already known from prior art, see document D2 and has already been employed for the same purpose (i.e. compression of data) in a similar system. It would therefore be obvious to the person skilled in the art, to either replace or reprogram the programmable logic device accordingly, taken the disclosures of document D2 into consideration, to arrive, without the involvement of any inventive skill, at a system as described in claim 65.

The same argumentation, *mutatis mutandis*, may be used with regard to the lack of inventive step of the subject-matter of claim 69, describing a corresponding device for decompressing data. Hence, claim 69 does not fulfill the requirements of Article 33(3) PCT with regard to the presence of an inventive step, either.

DEPENDENT CLAIMS 3 - 14, 18 - 28, 66 - 68 & 70 - 72

Dependent claims 3 - 14, 18 - 28, 66 - 68 & 70 - 72 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step (Article 33(3) PCT) for the following reasons:

Claims 3 - 6, 8 - 11, 19 - 27, 66, 67, 70 & 71 relate to the implementation of an compression / decompression and decryption operation in a programmable logic device. The implementation of various functions, among others the one mentioned above, is already known from prior art, e.g. document D2 (compression / decompression) and document D3 (encryption / decryption). Details about the compression / decompression algorithms used (claims 66, 67, 70, 71) may be regarded as mere implementation details, which the person skilled in the art would add without the need for any inventive skills.

For the same reasons already given in combination with the discussion of the subject-matter of claims 65 & 69, *mutatis mutandis*, the subject-matter of claims 3 - 6, 8 - 11, 19 - 27, 66, 67, 70 & 71 does not contain an inventive step in the sense of Article 33(3) PCT.

The remaining claims 7, 12 - 14, 18, 28, 68 & 72 refer to subject-matter, which is either general knowledge in the field of programmable logic devices or they refer to additions or implementations, which are obvious for the person skilled in the art. Therefore, these claims also do not fulfill the requirements of Article 33(3) PCT.

## Claim 16

Document D1 discloses a programmable logic device (see e.g. page 6, right hand column, lines 25 - 29: "... based on a simple cell that can be programmed to recognize a single character... These cells are then connected to form arrays ...") "The term detector can operate at a high bandwidth matching that of the disk, ..."). In view of these disclosures of document D1, claims 1, 2 & 17 do not fulfill the requirements of Article 33(2) PCT.

## 2. Claims 29 - 38

The subject-matter of independent claim 29 relates to a method to select a template defining one or more processing functions, which is loaded into a programmable logic device in order to implement certain processing functions in combination with a mass storage medium.

Document D5 contains a survey of systems and software used in configurable computing, i.e. using programmable logic devices, especially FPGAs. The document clearly describes the technical steps of loading pre-programmed blocks or clusters (i.e. templates) into the hardware (see e.g. page 14, third paragraph - page 15, first paragraph). The use of a floorplanning tool is described, which optimizes the placement of the selected logical blocks to be transferred into the FPGA, each block representing certain processing function. The floorplanning tool is at least considering the desired performance characteristic (page 14, last paragraph: "Because performance is best when routing is minimized,...") and amounts of programmable logic device resources consumed (page 14, fourth paragraph). Additional information about configuring the programmable array can be found on page 18, paragraphs "Partial Evolution" and "Memory

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Allocation", which disclose further details about the actual selection and placement step for preprogrammed logic functions, to be implemented as blocks (templates) in a corresponding programmable device.

The difference between the disclosures of document D1 and the subject-matter of claim 29 must be seen in the technical environment, in which the programmable device is supposed to be used (claim 29: "... the programmable device being configured to process data moving to or from the mass storage medium ...").

However, the technical environment does not have any technical impact on the actual claimed method of selecting a template for the programmable device and does consequently not result in any special technical effect. Therefore, it would be obvious to the person skilled in the art to use the methods of selecting a template for any programmable logic device, as disclosed by document D5, also in combination with a programmable logic device "... being configured to process data moving to or from the mass storage medium..." (claim 29).

The subject-matter of claim 29 does therefore not comprise an inventive step with regard to the content of document D5 (Article 33(3) PCT).

The dependent claims 30 - 38 describe further conditions, which should be taken into account when selecting a template to be transferred into a programmable logic device. These conditions are either disclosed by document D5 or they are obvious conditions for the person skilled in the art in order to maintain or improve a working status of the programmable logic device. It should be noted that a person skilled in the art would not select a certain template to be programmed onto the device if the effect on the processing of the device is known to be negative, e.g. usage of more resources or lowering data throughput.

The subject-matter of claims 30 - 38 does therefore also not comprise an inventive step (Article 33(3) PCT).

3. Claims 39 - 64

3.1 INDEPENDENT CLAIMS 39 & 53

Claim 39 is describing a data processing system including a programmable logic device to process data, wherein the programmable logic device is used to implement a plurality of stages as a processing pipeline, each stage being dedicated to a different processing operation.

The feature of using pipelined processing stages in programmable logic devices is clearly disclosed by document D6, see e.g. paragraph 1.0 "Introduction", paragraph 3.0 "Implementing Pipelined Applications using RTR" and Figure 2: "Example Pipelined Application" as well as by document D5 (page 23: "Pipeline Reconfigurable"). Figure 2 of document D6 also shows that each processing stage performs different processing operations (f, - fs) in a pipelined application, using multiple stages corresponding to the different functions (here: high-order FIR filter). The application to be implemented into the programmable logic device has multiple identically-sized pipelined stages, corresponding to the different processing stages of the filter.

The disclosure of D6 leaves doubt whether all pipelined stages are simultaneously implemented on the logic device. Document D5 is disclosing the (partial) reconfiguration of the pipelined stages, each stage is configured as a whole (page 23, paragraph "Pipeline Reconfigurable") and the document clearly discloses the possibility of implementing multiple pipelined stages onto one FPGA (see above mentioned paragraph: "Either the number of hardware pipeline stages available is greater than or equal to the number of pipeline stages of the desired circuit, It must be stated, therefore, that the subject-matter of claim 39 is disclosed by document D6, taking the general teaching of D5 into consideration, and consequently, claim 6 does not fulfill the requirements of Article 33(3) PCT (lack of inventive step).

Claim 53 is referring to a hard disk accelerator, essentially comprising a system as described by claim 39, additionally specifically arranged to process data streams coming from a hard disk drive.

The type of data which is processed by a programmable logic device, e.g. the one as described by document D6, does not contribute to the presence of an inventive step in the invention. The use of a programmable logic device to process data streams coming from hard disks is known in the prior art (see e.g. D1), and it is also known from prior art to implement multiple pipelined stages onto a programmable logic device, processing general data (see D6). The use of a programmable device as described by document D6 to process data coming from a hard disk can therefore not be regarded as inventive in the sense of Article 33(3) PCT, and the corresponding system, i.e. the hard disk drive accelerator as described by claim 53, consequently lacks an inventive step.

## Supplemental Box

3.2 DEPENDENT CLAIMS 40 - 52, 54 - 64

The dependent claims 40 - 52 and 54 - 62 are essentially describing different data processing functions, which can be programmed into the programmable logic device as described by claims 39 or 53. The use of these functions (compression, decompression, encryption, decryption, etc.) for processing general data is well known in the prior art. The use of a programmable logic device to perform these functions is also well known in the prior art (see e.g. documents D2, D3), also in combination with a continuous data stream, coming from a mass storage (see e.g. D1). The use of a programmable logic device to perform the well known functions in combination with data streams coming from a mass storage device would therefore be obvious for the person skilled in the art and consequently lead to the systems as described by the above mentioned dependent claims 40 - 52 and 54 - 64.

The subject-matter of claims 40 - 52 and 54 - 64 does therefore not comprise an inventive step in the sense of Article 33(3) PCT.

## Claims 73-85

The prior art document D1 (entire document) discloses a data storage medium as well as a corresponding method of discontinuous arcs located on the magnetic medium about a central origin.

In view of these disclosures of document D1, claims 73-85 do not fulfill the requirements of Article 33(2) PCT.

## 4. Claims 86 - 97

4.1 INDEPENDENT CLAIMS 86 & 92A

Claim 86 is describing a method of storing a data file of a known size on a storage medium. Depending on the file size, either a single block of storage space or a plurality of blocks of storage space having a certain predetermined size (equal to the power of 2) are requested.

Document D7 discloses a method for allocating computer disk space to a file of known size. In order to minimize loss of storage space due to failure to fill the segments of the disk completely, an efficient algorithm to determine the number and size of memory pages (i.e. storage blocks) needed is disclosed, which is technically corresponding to the method described by claim 86, the only difference being the missing step of explicitly checking whether the file size is an even power of 2 before requesting the blocks of storage space. It is technically not clear from the claim, however, whether this additional step is really meant to be a technically separate processing step of calculating and comparing the binary representation of the file size before any further operation, or whether this step is implicitly included into the subsequent step of requesting the needed plurality of storage blocks from the storage device, which is disclosed by D7.

However, even the explicit addition of this processing step to the method as disclosed by D7 does not result in any unexpected effect, and the examiner can not determine any problem, which is solved by this additional processing step. The technical effect of the method as disclosed by D7 and the method of claim 86 is identical.

The subject-matter of claim 86 does therefore not fulfill the requirements of Article 33(3) PCT (lack of inventive step).

The subject-matter of claim 92, as far as it can be understood due to a lack of clarity (Article 6 PCT), seems to be corresponding to the method as described by claim 86, additionally maintaining a minimum block size for the blocks of storage space on the storage medium and eventually rounding the requested number of storage space to a power of 2 (i.e. 2m).

Again, it must be stated that it is not clear from the claims whether the described steps of calculating and comparing the file size are in fact separately performed processing steps, and which problem is solved by the addition of these processing steps.

However, even the explicit addition of these processing step to the method as disclosed by D7 does not result in any unexpected technical effect, solving a potentially present problem, which the examiner is not able to determine. The technical effect of the method as disclosed by D7 and the method of claim 92 is identical and the rounding process for files smaller than a certain size (i.e. 2<sup>m</sup>) is equally disclosed by document D7.

The subject-matter of claim 92 does therefore also not fulfill the requirements of Article 33(3) PCT (lack of inventive step).

4.2 DEPENDENT CLAIMS (87 - 91, 93 - 97)

The subject-matter of claims 87 and 93 is highly unclear (Article 6 PCT), however, it seems to relate to the method of calculating the necessary requested block size out of a binary representation of the known file size, as described by document D7, second paragraph.

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The subject-matter of claims 88 - 91 and 94 - 97 must be seen as generally known methods in the field of file systems and memory allocation on mass storage devices, the addition of which to the subject-matter of any claim, on which the corresponding claims depend, would be obvious to the person skilled in the art.

The subject-matter of claims 87 - 91 and 93 - 97 does therefore also not fulfill the requirements of Article 33(3) PCT (lack of inventive step).

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